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Part VII

Water Resources Council

Heber Demonstration Plant, Geothermal Binary Electric Power Generation, Imperial County, Calif.; Water Assessment

WATER RESOURCES COUNCIL

Heber Demonstration Plant, Geothermal Binary Electric Power Generation, Imperial County, Calif.; Water Assessment

AGENCY: United States Water Resources Council.

ACTION: Notice of water assessment report for public review and comment.

SUMMARY: This notice incorporates the Water Assessment Report prepared by the Water Resources Council under the provisions of Section 13(b) of the Federal Nonnuclear Energy Research and Development Act of 1974.

DATE: Comments on this report are due on or before August 25, 1980.

ADDRESS: Send comments to: Gerald D. Seinwill, Deputy Director, U.S. Water Resources Council, 2120 L Street, N.W., Washington, D.C. 20037.

FOR FURTHER INFORMATION CONTACT: Frank S. Davenport, Program Leader or Ronald L. Scullin, Staff Specialist, U.S. Water Resources Council, 2120 L Street, N.W., Washington, D.C. 20037, phone: 202–254–6352.

Dated July 21, 1980.

Gerald D. Seinwill,

Deputy Director.

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Preface

The U.S. Water Resources Council (WRC) has prepared this report under provisions of Subsection (b) of Section 13 of the Federal Non-nuclear Energy Research and Development Act of 1974, as amended. The report is an assessment of water requirements and water supply availability for a proposed Geothermal Binary Demonstration Electric Generation Project near Heber, California. The four main sections of the report discuss the following topics: 1) principal findings, 2) Project description, 3) water supply and availability, and 4) effects of the Project.

The U.S. Department of Energy requested the WRC to perform this assessment on February 1, 1980. The WRC retained an engineering consultant to conduct technical phases of the assessment and to prepare a techical report. The technical report, completed on June 30, 1980, was the principal supporting document used by WRC staff to prepare this report.

Publication of this report in the **Federal Register** is mandated under provisions of Section 13 to enable public review and comment during a 30-day period. Comments on the report are to be submitted to: Gerald D. Seinwill, Deputy Director, U.S. Water Resources Council, 2120 L Street, N.W., Washington, D.C. 20037. After the 30-day review period, WRC staff will analyze the comments received, and will forward the comments, the WRC analysis, and the water assessment report to the Secretary of Energy.

The Water Resources Council will prepare a subsequent assessment of water resources availability for future commercial-scale geothermal development at this site in a separate report pursuant to Subsection 13(c) of the previously cited Act.

I. Principal Findings

A. Project and Associated Water Requirements

1. The proposed 45 megawatt (net) Geothermal Binary Demonstration Electric Generation Project near Heber, California (hereafter called the Project), will withdraw about 6,000 acre-feet of water per year for cooling system makeup. The Project also will require 15 acre-feet per year for sanitary purposes, washdown, and fire protection.

2. To convey heat energy, the Project will extract and utilize groundwater from the underground geothermal reservoir at a rate of 18,000 acre-feet per year. Following heat energy transfer to a hydrocarbon fluid, the groundwater will be reinjected into the geothermal reservoir, thereby maintining reservoir water content and preventing possible subsidence or seismic activity.

3. The Project will induce modest population growth with accompanying increases in municipal water requirements of 30 acre-feet per year.

B. Water Supply Availability

1. The Project developer, San Diego Gas and Electric Company, has contracted with the Imperial Irrigation District to take up to 6,000 acre-feet of water supplies per year from the District's Central Main Canal during the Project's 5-year demonstration period. The California Water Resources Control Board has approved a permit for diversions of 50,000 acre-feet per year from the New River, which will serve as the long-term source of water for the commercial Project.

2. The Colorado River is the source of water supplies for the Imperial Irrigation District. A Supreme Court decree has allocated waters in the Lower Colorado River Basin among the Lower Basin States. The decree also protects diversion of water by water supply entities in California. Under terms of an agreement among the water supply entities, the Imperial Irrigation District has high priority for use of the Colorado River supplies available to California. The District should have a long-term supply of at least 2.7 million acre-feet per year.

The Upper Colorado River Basin is not expected to divert its full 7.5 million acre-feet per year Compact entitlement during the estimated 30-year Project lifetime. Therefore, Colorado River water supplies available to the Lower Basin should be sufficient to meet or exceed its Compact entitlement.

3. Flows in the New River are derived from municipal and industrial wastewaters discharged in Mexico and agricultural drainwaters that originate in both Mexico and California. The current average annual flow is about 113,000 acre-feet at the proposed diversion point, Clark Road Crossing. These flows should continue for the Project lifetime unless irrigation within the Imperial Irrigation District is measurably reduced from present levels. If irrigation is reduced, the District would probably have additional supplies available for purposes other than irrigation.

4. Groundwater supplies in the Project area are minimal, with low potential for productive wells. Groundwater is not a reasonable supply source for the Project.

C. Water Resources Impacts

1. Project withdrawals from the Central Main Canal of the Imperial Irrigation District will not impact upon other users of the Canal.

2. The withdrawal of water supplies from the New River will reduce the inflow of water to the Salton Sea and will slightly retard the Sea's current water level rise. Withdrawals from the New River will also reduce the water available to dilute the salinity of the Salton Sea and will hasten the salinity rise to a concentration of 40,000 parts per million (ppm). Concentrations of 40,000 ppm are generally considered to be the upper threshold for survival of the corvina sport fishery.

3. During the 5-year demonstration period, blowdown from the Project cooling system, with a temperature of about 90°F, a salinity of about 4,000 ppm, and a rate of discharge of about 1,350 acre-feet per year, will be discharged to the adjoining Beech Drain. Discharge salinity will be within discharge requirements of the Regional Water Quality Control Board and will not significantly affect the New River which receives the drainage flows.

4. After the 5-year demonstration period, the use of more saline New River water for cooling system makeup will increase blowdown salinity to up to 20,000 ppm. In this case, the blowdown water will be injected into the underground reservoir along with the geothermal brines or disposed of in evaporation ponds.

II. Project Description

A. Project Features

Type of Energy Process

The proposed Geothermal Binary Demonstration Electric Generation Project near Heber, California, involves construction and demonstration of a thermal electric generating plant that uses the heat from extracted groundwater brines as the energy source. The Project will be the first full-scale application of the "binary process," which uses the heat from the extracted groundwater to vaporize a hydrocarbon medium. Electricity is produced by expanding the hydrocarbon vapor through a turbine that drives an electric generator.

Project Participants

The Project will be constructed and managed by the San Diego Gas and Electric Company (SDG&E) with financial participation by the U.S. Department of Energy (DOE). The Los Angeles Department of Water and Power, Imperial Irrigation District, the California State Department of Water Resources, the Electric Power Research Institute, and several electric power utility companies may also participate financially. Power generated at the Project will be sold to the Imperial Irrigation District or transmitted to the co-owners' service areas.

Project Site

The Project will occupy a 20-acre site in Imperial County, California (see Figure 1). The location, on the floor of the Imperial Valley, is 4 miles north of the Mexican border and 100 miles east of the San Diego metropolitan area. The California-Arizona boundary and the coincident channel of the Colorado River are about 48 miles east of the proposed site. Irrigated farmlands served by the Imperial Irrigation District surround the site. The Central Main Canal, the Beech Drain, and the New River are important elements of the District's water distribution and drainage system shown in Figure 2.

The temperatures in the Imperial Valley average 91°F in July and 52°F in December. Rainfall is very limited, averaging 1 to 3 inches per year.

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Figure 1
Location of Project

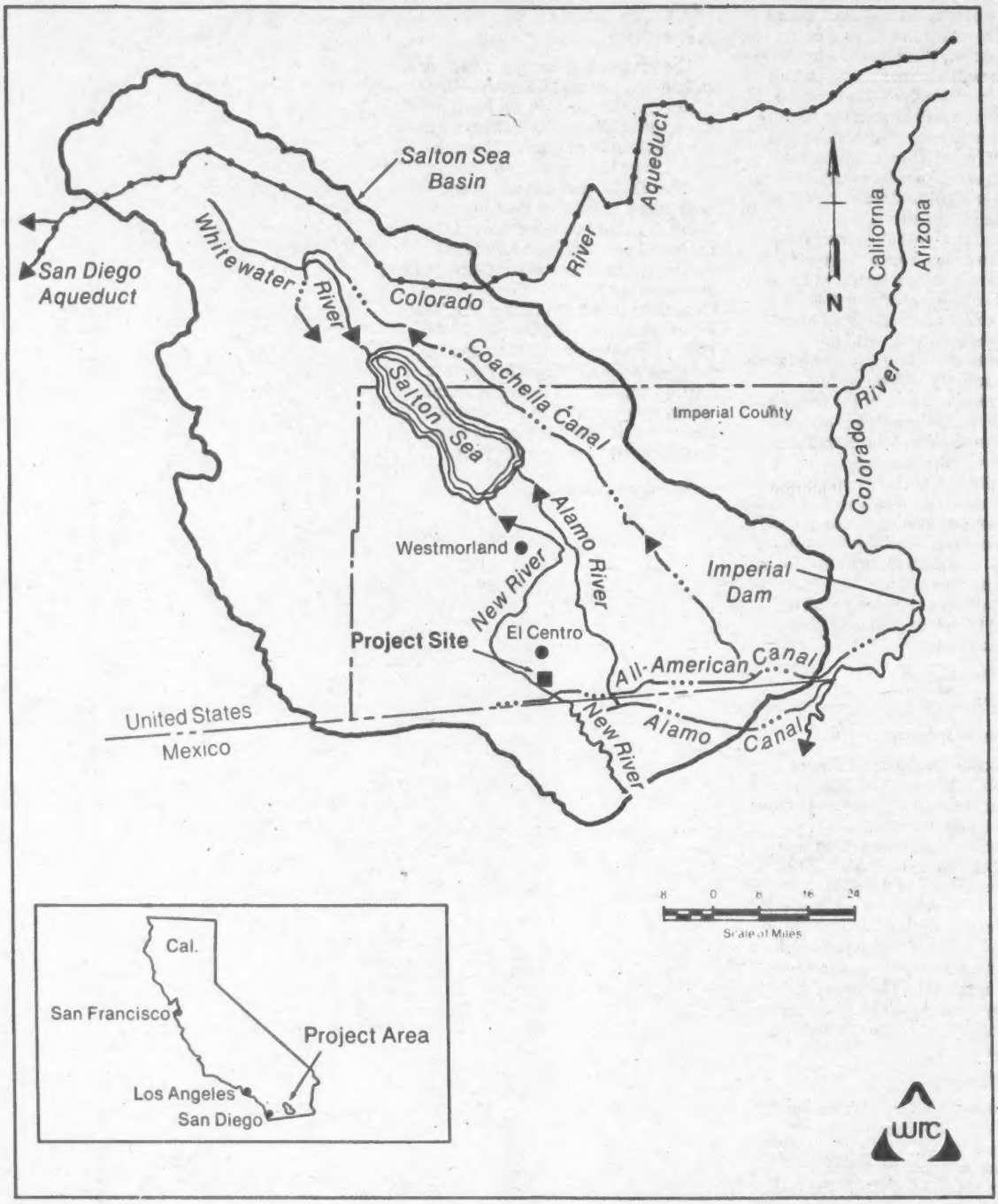
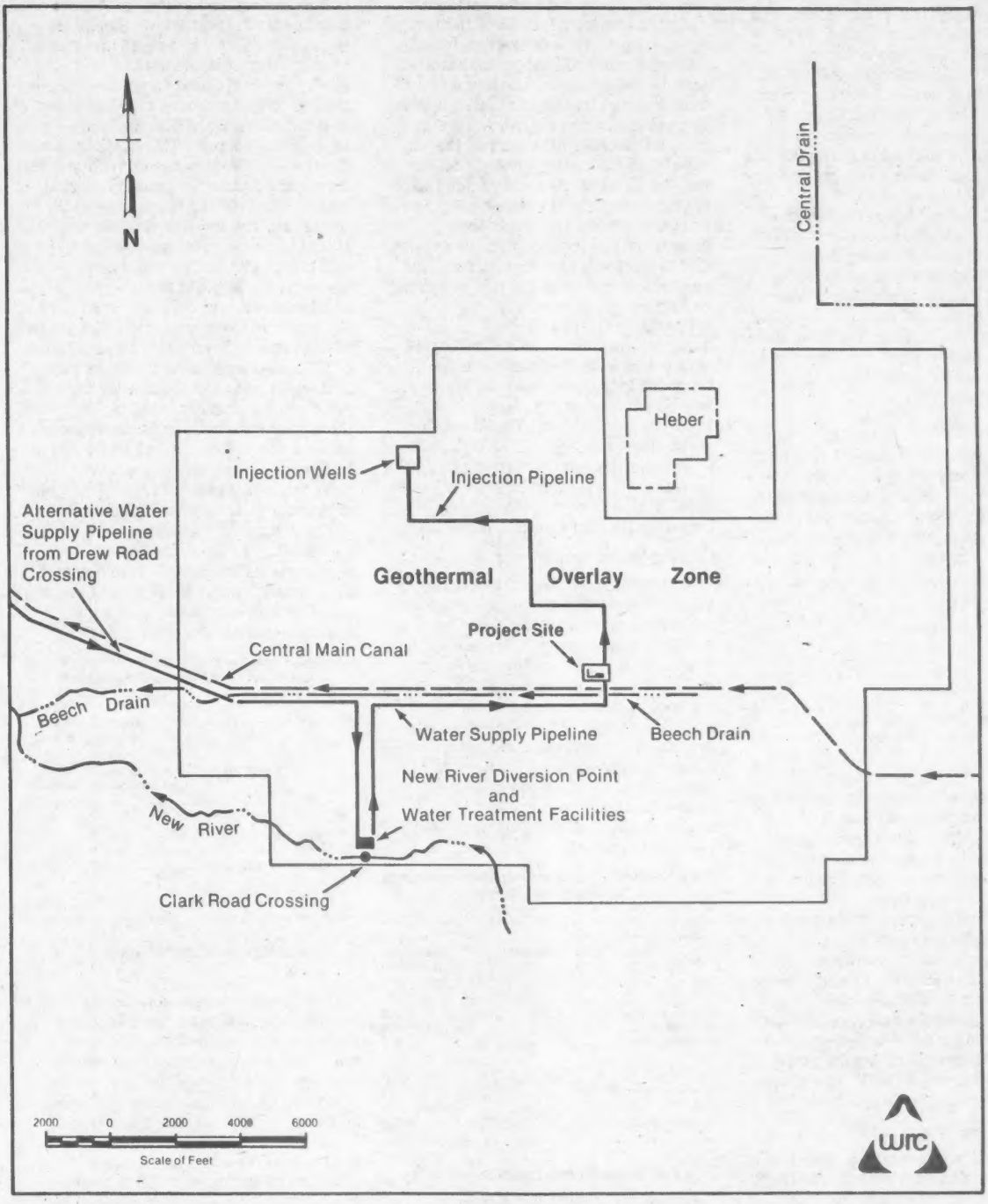


Figure 2
Project Features



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Geothermal Resources

The Project will use the heat energy of brines in the Heber Reservoir, one of four known underground geothermal resource areas in the Imperial Valley. The Heber Reservoir has brine temperatures of about 360°F and salinities (expressed as total dissolved solids or TDS) in the range of 14,000 ppm. The U.S. Geological Survey estimates that the energy potential of the Heber Reservoir is 1,000 megawatts (MW) for at least 30 years. Chevron Resources Company, a major leaseholder for the Heber reservoir, has concluded that Heber has a proved resource capacity of 500 MW.

Imperial County has established a planning zone in the Heber area called Heber Geothermal Overlay Zone. This zone generally covers the reservoirs area (see Figure 2). The County has issued a Geothermal Production Permit to SDG&E dated January 22, 1980, which authorizes construction and operation of a 45 megawatt net geothermal demonstration plant.

Development Schedule

San Diego Gas and Electric Company anticipates completing a cooperative agreement with DOE by the summer of 1980. The following schedule depends upon the actual date the agreement is executed:

Project phase	Time of completion (years after agreement)
Construction and initial operation	4.5
Demonstration period	6.5
Final report on demonstration	6.8

Project Facilities

The Project will consist of production wells and pumps for extraction of geothermal brines; injection wells and pumps for reinjection of cooled brines; brine-hydrocarbon heat exchanges; a turbine generator; a hydrocarbon condenser and pumps; a cooling water system; and settling ponds.

The Project's gross generation capacity will be 65 MW. This includes and estimated 15 MW of power for the pumps for condenser and cooling water functions and for brine extraction and injection. Other inplant requirements will be an estimated 5 MW. The plant's net generation capacity will be 45 MW.

B. Water Requirements

The Project's major water requirement will be for the cooling system. Cooling water will be circulated continuously through the plant's hydrocarbon condenser where the exhausted hydrocarbon vapor from the turbine is liquefied. Water from the condenser will be passed through cooling towers and recycled to the condensers to repeat the cooling process. Water will be lost from the system through evaporation and removal of a concentrated residual called "blowdown". Besides being a direct water loss, evaporation from the cooling towers concentrates dissolved salts in the remaining cooling water so that it cannot be recycled indefinitely. The contaminated blowdown water must be discharged to control the salinity of the cooling water. Makeup water will be continuously added to the system to replace the water evaporated from the cooling tower and the blowdown discharged from the system. The Project will also require smaller amounts of water for potable supplies and attendant growth.

For the first 5 years, the demonstration phase, the Project will take water from the Imperial Irrigation District's irrigation water supply. Water will be pumped to the plant from the District's Central Main Canal south of the Project site (Figure 2). For the long-term, after the demonstration phase, the Project will use water from the New River, which is part of the Imperial Irrigation District's drainage system.

Cooling Water Requirements

At maximum plant output, cooling tower evaporation and wind-drift losses are estimated at 4,100 acre-feet per year and 20 acre-feet per year, respectively. The estimated blowdown rate is 1,350 acre-feet per year, regardless of whether the cooling water is taken from the irrigation supply or from the drainage system. A 10-percent contingency, which accounts for possible variations in the estimates of make-up requirements, brings the total cooling water requirements to about 6,000 acre-feet per year (see Table 1).

Table 1.—Cooling Water Makeup Requirements at Maximum Plant Output

Cooling system component	Water requirement (acre-feet per year)
Tower evaporation	4,100
Wind-drift	20
Blowdown	1,350
Subtotal	5,470
10% Contingency allowance	530
Total	6,000

Potable Water Requirements

Potable water supplied from the irrigation canal by a hydropneumatic system will be given settling and chlorination treatment. This use would probably be less than 10 gallons per minute (gpm), or a total of about 15 acre-feet per year.

Induced Development Requirements

The Project is expected to require a maximum of about 270 workers during the construction period and about 30 workers during operations. Environmental impact studies indicate that up to 60 percent of these workers and their families will come from outside the country. This could increase the water-using population by about 800 during the 2-year construction period and by about 90 for the commercial operation. The increased water use would be about 270 acre-feet per year and about 30 acre-feet per year, respectively. Most of these new residents will probably live in El Centro, the Imperial County Seat, 5 miles north of the Project (Figure 1). The population of El Centro was about 21,000 in 1976, and water use was about 7,000 acre-feet per year. The increased water use during the construction phase represents about 4 percent of present water use in El Centro. During operation, water requirements represent about 1 percent of present water use in El Centro.

The estimated water requirements are summarized in Table 2. Water requirements for potable supplies and for attendant population growth are not significant in comparison with the requirements for the cooling system.

Table 2.—Summary of Water Requirements for the Project and Induced Development

Type of use	Water requirements (acre-feet per year)	
	During construction	During operation
Plant Use		
Cooling system	0	6,000
Potable supplies	15	15
Attendant population growth	270	30
Total	285	6,045

C. Waste Products and Disposal Methods

Geothermal electric generation would produce the following types of waste products: cooled geothermal brines, cooling tower blowdown, site runoff, sewage, and brine sludge.

Cooled geothermal brines with about 14,000 ppm TDS and a temperature of about 160° F will be returned to the geothermal reservoir in the same amounts as the extracted hot brines (about 18,000 acre-feet per year). The used brine will be piped 2 miles to the

injection wells (see Figure 2). Underground reinjection will prevent the reservoir from losing pressure, which could result in land subsidence and seismic activity.

Cooling tower blowdown is estimated at 1,350 acre-feet per year. Disposal depends on its salinity, which in turn is determined by the salinity of the makeup water source, which is either the irrigation supply or the more saline irrigation drainage water.

When the irrigation supply (salinity of 900 to 1,000 ppm) is used for makeup, the blowdown water will average about 4,000 ppm salinity and about 90° F temperature. The Project sponsor plans to discharge this blowdown to Beech Drain immediately south of the Project site.

When the cooling water is taken from agricultural drains (salinity of up to 4,000 ppm) or from the New River (salinity of up to 5,000 ppm), the blowdown salinity will be in the range of 20,000 ppm. Because of State wastewater discharge standards for agricultural drains, this saline blowdown could not be discharged to Beech Drain. Instead, it will be injected into the underground reservoir with the used geothermal brines or conveyed to evaporation ponds, which could be constructed in an undeveloped desert site some 9 miles west of the Project.

Surface site drainage during rainstorms and from any leaks or breaks in the Project's pipelines could contribute as much as 4,000 to 5,000 gpm to runoff. Therefore, flows will be collected and discharged to Beech Drain after any oil is removed. The pipelines that convey the brines from the producing wells to the plant and from the plant to the injection wells will have safety factors and will be installed in lined trenches. Any brine leakage will be collected, pumped into a pipeline, and conveyed to the cooled brine pipeline.

Sewage wastes generated by construction peronnel will be collected in potable sanitary facilities and hauled to a sewage disposal plant. The Project's facilities will include septic tanks. Solid materials from the extracted brines, primarily sand, and brine sludge that collects in the condenser system will be disposed of in accordance with Imperial County's solid waste requirements.

III. Water Supply and Availability

A. Water Conditions

The Project is located in the Colorado Desert Hydrologic Area. Rainfall averages less than 5 inches per year and natural surface water flows are negligible. The Imperial Irrigation District has developed an extensive water distribution system supplied by the Colorado River. The Project will use the District's irrigation and drainage facilities to supply its water and, during the initial (first 5 years) phase, for discharge of blowdown water.

Imperial Irrigation District

The Imperial Irrigation district is one of the irrigation systems that distribute the Colorado River water diverted by the All American Canal at the Imperial Dam (Figure 1). The Project will use both the District's irrigation and drainage facilities.

Irrigation System: The Imperial District's Central Main Canal (Figure 2), which runs adjacent to the Project site, is proposed as the initial source of water for the Project during the demonstration phase (first 5 years). The Central Main Canal's conveyance capacity of nearly 800,000 acre-feet per year supplies irrigation water to a large portion of the Imperial Irrigation District's system. The salinity (TDS) of the irrigation water is estimated at about 900 to 1,000 ppm.

Drainage System: Elements of the Imperial District's drainage system, the New River or smaller agricultural drains, are proposed as the long-term water source for the Project.

The New River constitutes one of the main facilities of the District's drainage system, which collects irrigation water that is not consumed by crops and ultimately conveys the water into the Salton Sea. The river channel runs within 1 mile of the Project. There are two proposed points of diversion—one at the Clark Road Crossing and the other at the Drew Road Crossing 9 miles downstream from Clark Crossing.

The average annual flow of the New River at Clark Road Crossing, near the Mexican border, is about 113,000 acre-feet per year. A large portion of the flow from Mexico is sewage effluent from Mexican industries and communities and irrigation water return flows. In the United States, the river receives about 300,000 acre-feet of drainage water per year so that when it discharges to the Salton Sea near Westmorland, its average annual flow is about 413,000 acre-feet per year. However, the estimated average annual natural flow of the New River near Westmorland is only about 3,000 to 4,000 acre-feet per year.

The Drew Road Crossing is an alternative diversion point that would be used instead of the Clark Road Crossing if drainage inflows at the latter are reduced by Mexico. Drainage flows collected in California between Drew Road and Clark Road are estimated to be near 50,000 acre-feet per year.

The water in the New River near Clark Crossing has high salinity. Project plans anticipate 5,000 ppm TDS. Suspended solids levels were more than 160 ppm and fecal coliform levels averaged 2.7 million colonies per 100 milliliters during 1977. Water for the Project will be disinfected and passed through settling ponds. Irrigation drainage dilutes the New River salinity to about 4,000 ppm near Westmorland. New River inflow to the Salton Sea has a dilution effect on the salinity of the Sea.

An alternative long-term source of water for the Project is a diversion from one of the Imperial System's smaller drains that has a lower salinity than the New River. Central Drain is the nearest drain where flows may be expected to consistently exceed 6,000 acre-feet per year; measurements show flows of more than 28,900 acre-feet per year. The Project could divert drain flows, but a pump facility and a pipeline to the Project site would be needed. Central Drain has an estimated average salinity of up to 4,000 ppm.

During the initial Project phase when irrigation water from the Central Main Canal supplies the cooling system, the blowdown water will be discharged to Beech Drain. Beech Drain runs along the southern edge of the Project site and discharges to the New River 1.5 miles to the west. The flows in Beech Drain range from 3,610 to 7,230 acre-feet per year with a temperature of about 66° F. Drainage water salinity is about 3,700 ppm.

Salton Sea

The Salton Sea, formed by a failure of diversion works in the early 1900's, has no outlet and is sustained primarily by irrigation drainage. Estimated inflow to the Sea, including measured and unmeasured surface flow and groundwater inflow, averages about 1.4 to 1.5 million acre-feet per year. Estimated evaporation is presently about 1.3 to 1.4 million acre-feet per year.

Salton Sea water levels have increased since the 1920's. The present (1979) water surface elevation is about 228 feet below sea level and is expected to rise by about 0.3 foot per year. The rate of rise would decrease slightly each year as surface area and evaporation increase.

The salinity of the Salton Sea, which is steadily increasing because of evaporation, was about 38,700 ppm TDS in 1978 and is expected to reach 40,000 ppm by 1990. Studies indicate that 40,000 ppm TDS would reduce the reproductive capability of the bairdiella and the

sargo, two species of forage fish for the game fish corvina.

Groundwater

Groundwater in the Heber area may be considered in two general categories, the hot geothermal waters occurring at depths of 2,000 to 6,000 feet, which are the intended source of heat for the Project, and the water that saturates the relatively fine-grained materials between the ground surface and a depth of about 2,000 feet.

Wells in the Heber area produce water of very poor chemical quality, with dissolved solids concentrations up to 10,000 milligrams per liter. Because production capacity is also limited, the Project ruled out groundwater pumping as a reasonable water source.

B. Water Availability

Water supply availability for the Project depends upon the continued availability of water supplies from the Colorado River and the continued use of irrigation in the Imperial Irrigation District. Colorado River water is allocated to the Imperial District according to vested water rights.

Colorado River Water Rights

The average undepleted flow of the highly regulated Colorado River is about 15 million acre-feet per year. The flow is apportioned between the Upper Basin States (Wyoming, Colorado, New Mexico, and Utah) and the Lower Basin States (California, Arizona, and Nevada) according to the Colorado River Compact of 1922; each basin has a total allocation of 7.5 million acre-feet per year for beneficial consumptive uses. The Mexican Treaty of 1944 guarantees to Mexico a discharge of 1.5 million acre-feet per year from the Colorado River.

According to a Supreme Court action, out of the 7.5 million acre-feet per year allocated to the Lower Basin, California has a right to at least 4.4 million acre-feet per year. California can also use 50 percent of any excess above the 7.5 million acre-feet per year. The average annual depleted flow of the Colorado River to the Lower Basin is estimated to be 11.3 million acre-feet under present (1975) conditions and is projected to be about 9.5 million acre-feet by 2000. This supply will be sufficient to satisfy the 7.5 million acre-foot per year Lower Basin entitlement, reservoir evaporation, and the Mexican commitment. Therefore, it is reasonable to assume that enough water will be available to fulfill California's right to 4.4 million acre-feet per year until after 2000.

California established priorities to divide its annual 4.4 million acre-foot allocation among agricultural and municipal water supply agencies. Several agricultural agencies, including the Imperial Irrigation District, are entitled to a total of 3.85 million acre-feet annually. In the past, these agencies have sometimes used more than 3.85 million acre-feet per year because to date, Arizona has not diverted its full allocation of Colorado River water. When the Central Arizona Project begins operation in the late 1980's, however, California agricultural agencies will be limited to the 3.85 million acre-feet per year. The Imperial Irrigation District might expect a diversion level of about 2.7 million acre-feet per year after full diversions by Arizona.

Project Water Rights

Imperial Irrigation District Agreement: For the Project's initial water supply, SDG&E formed an agreement with the Imperial Irrigation District for diversion of irrigation water. This "Water Supply Agreement between San Diego Gas and Electric Company and Imperial Irrigation District" was executed on October 18, 1979. Under this contract, the District agreed to allow SDG&E to take up to 6,000 acre-feet of water per year from the District's Central Main Canal for the Project for up to 5 years during the demonstration period.

California State Water Resources Control Board Permit: The Water Resources Control Board claims jurisdiction over diversions from the New River. Because of this and because most of the flows at the Clark Road Crossing originate in Mexico, rather than in the Imperial Irrigation District, both San Diego Gas and Electric Company and Chevron Resources Company applied to the Board for appropriation of water from the New River for geothermal generation plants in the Heber area. The Board recently announced that permits will be issued to both parties. The New River diversion point for the permits would be at the Clark Road Crossing shown on Figure 2, which is about 1.5 miles southwesterly of the Project site. The Project could also use an alternative diversion point downstream at the Drew Road Crossing. The total diversion capacity covered by the two companies' permits is 50,000 acre-feet per year.

Adequacy of Supply

Project water requirements, 6,000 acre-feet per year, are a small fraction of the flows in both the Central Main Canal (proposed water source for the 5-year demonstration period) and the New River (proposed water source for long-term operations). The availability of water from both the canal and the river depends upon continued availability of water to the Imperial Irrigation District. The District should receive at least 2.7 million acre-feet of water per year over the long-term. Therefore, the Project should have a sufficient water supply.

C. Potential Instream and Offstream Competing Uses

Irrigation Water Supplies

The Central Main Canal is used solely as an irrigation conveyance facility and has no other instream use. There are no instream flow conflicts.

No offstream uses now compete for the irrigation water. Under present levels of irrigation development, the Project will not affect current irrigation customers of the Imperial Irrigation District. However, if additional lands are developed for irrigated agriculture during the demonstration period, the Project would compete with the agricultural sector. In this case, the Project could switch to the drainage water source or sources.

Drainage System

The flows of the New River, with salinities ranging from about 5,000 ppm to 4,000 ppm in the downstream direction, have a dilution effect that tends to slow the salinity increase in the Salton Sea. The Project's use of New River or other agricultural drainage water will conflict with the dilution function and, consequently, with the maintenance of the Salton Sea sport fishery.

There is also a small fishery resource in the downstream reach of the New River. Although the Project would slightly reduce the quantity of water in the downstream area, the removal of highly contaminated New River water would actually improve the water quality downstream and would probably not be a competing use.

IV. Effects of the Project

The Project's construction, water use, and effluent discharge may affect water and cultivated land resources of the area, especially the New River and the Salton Sea. The Project's possible effects are different between the demonstration period and long-term operations because the water supply source and blowdown disposal methods are not the same for the different time periods.

A. Irrigation System

Water withdrawals from the Central Main Canal during the Project's demonstration phase will insignificantly

affect the Imperial Irrigation District's water system and water supply. The proposed withdrawal, 6,000 acre-feet per year, represents a less than 1 percent reduction in the canal capacity. Under present levels of irrigation development, the Project will not reduce water deliveries to the Imperial District's irrigators.

B. Beech Drain

While irrigation water serves as the supply source during the 5-year demonstration phase, blowdown water can be discharged to the Beech Drain. The blowdown discharge, 1,350 acre-feet per year, will increase the flow in Beech Drain by 20 to 40 percent. The increased flows, however, will not limit the drain's effectiveness in controlling groundwater levels in adjoining fields.

The blowdown discharge could raise the average temperature of the drainwater by 6° F. This will slightly reduce Beech Drain's temperature lowering effect on New River water. Blowdown water (with TDS of 4,000 ppm) will slightly increase the salinity of Beech Drain. However, the discharge salinity will not exceed the probably limit of 4,000 ppm that the Regional Water Quality Control Board will require. Other discharge constituents in the blowdown water will also be within the limits expected from the Regional Board.

C. New River

Discharge of blowdown to Beech Drain during the demonstration period will cause an insignificant rise, 1,350 acre-feet per year, in the flows of the New River 2.5 miles downstream of Clark Crossing. The slight rise in the water temperature in the Beech Drain will not significantly affect the New River because the river flows are large (113,000 acre-feet per year) in comparison to the modified drain flows (5,000 to 8,600 acre-feet per year).

The salinity of the Beech Drain flows as modified by blowdown discharge will be 4,000 ppm or less. Although this level is less than the New River salinity, which averages about 5,000 ppm near the point of the Beech Drain discharge, the Drain's local salinity-lowering effect on the New River might be slightly reduced. Furthermore, the irrigation canal water would add some 7,500 tons per year to the New River and the Salton Sea during the demonstration period. This effect will cease when drainage water is used for cooling.

When the Project uses the New River as its water source, the withdrawal of 6,000 acre-feet per year at the Clark Crossing will deplete the average river flow by about 5 percent. Downstream, the flow reduction near the Salton Sea outlet will be less than 2 percent. These flow reductions are not significant. The withdrawal of water from the Clark Road Crossing will insignificantly reduce (20 ppm) salinity of the New River near the Salton Sea. Injection or evaporative disposal of blowdown water containing about 44,000 tons of salts per year will reduce by this amount the salts in the New River and the Salton Sea.

D. Salton Sea

The discharge of blowdown to Beech Drain will add about 7,500 tons of salt per year to the Salton Sea. This is insignificant compared to the present annual inflow of salts. Blowdown injection could mitigate this effect. The problem will cease when drainage water is used in the cooling system.

The Project's 6,000 acre-foot per year reduction of New River inflow to the Salton Sea will tend to slightly reduce the rise of the Sea's water levels and the damage caused by the rise. On the other hand, diversion of the cooling water supply from the New River and injection or evaporation of the blowdown will result in a net reduction of the River's dilution effect on the Salton Sea. Although the inflow of salt would be reduced by 44,000 tons per year, the removal and evaporation of New River water will cause the Salton Sea salinity to reach levels that will damage the sport fishery (40,000 ppm) about 3 months earlier than it would without the Project. The damaging levels might be reached 4 months earlier if cooling water is taken from an agricultural drain where water salinity is lower and the corresponding dilution effect is greater. The increase of salinity in the Sea is apparently inevitable, however, the California Water Resources Control Board found this rise to be a pre-existing condition and did not require any mitigating measures for the proposed diversion.

E. Groundwater

The Project is not expected to have any significant effects on the quantity or quality of the hot groundwater brine resource that fuels the Project. After its heat is extracted, this groundwater will be returned to the same general depths (2,000 to 6,000 feet) from which it is pumped.

The Project should also have no significant impact on the shallower zone of groundwater that lies between the ground surface and a depth of 2,000 feet. None of this groundwater will be used by the Project. Pipelines for transport of the hot, highly saline geothermal brines will be laid in concrete-lined ditches. Any leakage will be carried in the ditches to collection pumps where the water will be collected and taken to a disposal site. This should prevent any seepage of brine into the groundwater under the Project site.

The production and injection wells will be sealed in the zone between the ground surface and a depth of 2,000 feet so that there will be no leakage from the wells to the shallower groundwater zones. Relatively impervious layers of materials at depths of 500 feet or more would prevent the more saline waters from moving upward from the deeper to the shallower zones. The injection process would maintain fluid pressures in the geothermal production zones at their present levels.

F. Cultivated Lands

Wind-drift of saline water droplets from the cooling towers (20 acre-feet per year) will deposit about 554 tons of salts per year on the irrigated lands adjoining the Project site. This is less than 0.9 ton per acre or less than 20 percent of the salts that irrigation normally applies to the land each year.

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